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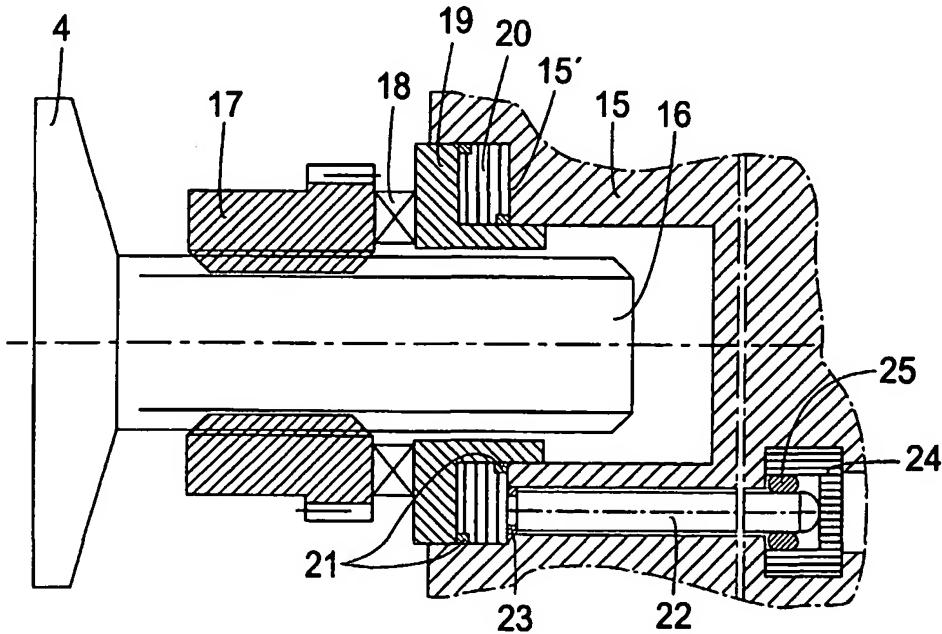
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[Continued on next page]

(54) Title: A DEVICE IN A VEHICLE BRAKE ARRANGEMENT



(57) Abstract: A device in a vehicle brake arrangement for determining the applied brake force comprises an enclosed elastically deformable medium (20), on which the reaction force from the brake force is to act. An axially movable push rod (22) is in contact with the medium (20) for transmitting a force therefrom, and sensor means (26; 28) are provided for sensing the force in the push rod.

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— *with international search report*

*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

**A DEVICE IN A VEHICLE BRAKE ARRANGEMENT****Technical Field**

5       The present invention relates to a device in a vehicle brake arrangement for determining the applied brake force, comprising an enclosed elastically deformable medium, on which the reaction force from the brake force is to act.

**Background of the Invention**

It is well known in the art that it is important in for example a brake applied by a rotating electric motor to obtain a signal corresponding to the applied brake force in order to be able to control the rotation of the motor and thus the brake application in a desirable fashion.

15       Examples of prior devices for this purpose are shown in EP-B-0 334 435, DE-A-196 52 230, and WO-A-9937939.

20       A recognised problem with devices of this nature is that the heat in the brake arrangement due to its operation may cause difficulties both with the physical properties of the used sensor means and the accuracy of their outputs.

The main object of the invention is thus to obviate this problem.

**The Invention**

25       For this and other reasons a device according to the invention is characterized in that an axially movable push rod is in contact with the medium for transmitting a force therefrom and that sensor means are provided for sensing the force in the push rod.

30       By the provision of a force-transmitting push rod the sensor means may be positioned in a portion of the brake arrangement where the heat is not a major problem and where also for other reasons it may be more advantageous to position the sensor means.

35       The dependent claims relate to advantageous details of the device.

**The Drawings**

The invention will be described in further detail below under reference to the accompanying drawings, in which

5 Fig 1 is a very schematic, partly sectional side-view of a first disc brake arrangement with a force sensing device,

10 Fig 2 is a very schematic, partly sectional side-view of a second disc brake arrangement with a force sensing device,

Fig 3 is a side-view to a larger scale of the portion to the right in Fig 2 of the force sensing device, and

15 Fig 4 shows an alternative embodiment to the one of Fig 2.

15 **Detailed Description of Embodiments**

Fig 1 shows a portion of a disc brake for a heavy road vehicle as for example shown in Fig 1 in PCT/SE00/02402. In this disc brake a thrust rod 1 is arranged in a housing 2. A rotative movement for brake application is imparted to a thrust rod gear 3 from an electric motor (not shown) via transmission means (not shown). The thrust rod 1 has means for transferring this rotating movement into an axial, brake-applying movement of a brake pad attachment plate 4. The thrust rod 1 is supported in the housing 2 by an axial bearing 5, which transfers the reaction force at a brake application to the housing 2.

30 This reaction force to the brake force is here transmitted over an annular pressure-transmitting medium 6, preferably of rubber, enclosed by a flanged ring 7 in contact with the axial bearing 5. A pressure sensor 8 is in contact with the medium 6 and supplies in an electric line 9 an electric signal indicative of the pressure in the medium 6. Alternatively, the pressure sensor 8 may be 35 embedded in the medium 6.

The signal transmitted from the pressure sensor 8 may be used to stop the brake application by means of the electric motor (not shown) when a desired brake force has been attained.

5       The disc brake embodiment shown in Figs 2 and 3 corresponds in a simplified form to that of Fig 6 in the above mentioned international patent application. The following main members may be recognized herefrom: a disc brake caliper housing 15, a thrust rod spindle 16, a nut member 17, an axial bearing 18, and a ring 19. For a fuller 10 description of the disc brake, reference is made to the international patent application.

It is here sufficient to note that the reaction force at a brake application is applied to the right in the 15 drawing on the ring 19, which here is flanged. This force is transmitted to a housing abutment 15' via an annular pressure-transmitting medium 20, preferably of rubber, provided with sealing rings 21 for preventing the medium 20 to be pushed out between the housing 15 and the ring 19. 20 The medium 20 may be defined as "an enclosed elastically deformable medium".

A push rod 22 is axially movably arranged in a corresponding bore in the housing 15 and is in contact at its left end with the medium 20 over a portion with reduced 25 diameter surrounded by a sealing ring 23, for example made of Teflon® possibly with an additive.

At its opposite end the push rod 22 is in contact with a force-receiving cup 24. The push rod 22 may here be surrounded by a guiding and centering O-ring 25, which does 30 not transmit any forces. By the fact that the push rod 22 has a rounded end, the contact area with the cup 24 is very small. In the region of the engagement of the push rod 22 with the cup 24, which may be made of a ceramic material, the cup may be provided with an integrated sensor element 35 26 indicated in Fig 3. Signals indicative for the force

applied by the push rod 22 and thus the pressure in the medium 20 may be transmitted from the sensor element 26 via electric lines 27.

It is thus evident that the pressure in the pressure-transmitting medium 20 is transformed into a force in the push rod 22 and transmitted to a place outside the area of the construction where high temperatures may cause hazards for the equipment and lead to uncertain results.

An arrangement with certain modifications in relation to that of Fig 2 is shown in Fig 4. Similar parts have the same reference numerals as in Fig 2.

In this arrangement the annular pressure-transmitting medium 20 can be placed in an annular groove in the brake caliper housing 15 and be acted on by the ring 19. Sealing can be provided by sealing rings 21.

Further, in this arrangement the push rod 22 may in itself be rigidly supported by the housing 15 and along its length be provided with a force-sensing means 28. This force-sensing means 28 may be an integrated portion of the push rod 22 or be connected in the rod.

In the shown and described devices the pressure in the annular pressure-transmitting medium 20 is further transmitted as a force in the push rod 22 in the axial direction of the thrust rod spindle 16. However, as the pressure is uniformly distributed in the medium 20, the push rod 22 may have any suitable direction in relation to the thrust rod spindle 16.

It is within the scope of the appended claims to make use of a push rod linkage instead of just a single push rod. The purpose of such a linkage would for example be to transfer the force to any suitable place for the sensor means.

The pressure-transmitting medium 20 is preferably rubber, but other materials are conceivable. The medium

shall generally speaking be plastically deformable, like a hydraulic fluid.

In order to assure very precise results, several arrangements of the kind shown in Figs 2-4 may be provided in a single disc brake, for example one for each thrust rod, when a disc brake is provided with more than one such thrust rod. Their results may be added and a mean value calculated. It may, however, be sufficient to have only one arrangement as shown.

**CLAIMS**

1. A device in a vehicle brake arrangement for determining the applied brake force, comprising an enclosed elastically deformable medium (20), on which the reaction force from the brake force is to act, characterized in that an axially movable push rod (22) is in contact with the medium (20) for transmitting a force therefrom and that sensor means (26; 28) are provided for sensing the force in the push rod (22).  
10 2. A device according to claim 1, characterized in that the force-sensing means (26) comprises a fixed force-receiving cup (24), in which the end of the push rod (22) opposite the medium (20) engages and which is provided with a sensor element (26) in its region for the engagement with the push rod (22).  
15 3. A device according to claim 2, characterized in that the push rod (22) in the region for its engagement with the force-receiving cup (24) is provided with a guiding and centering O-ring (25).  
20 4. A device according to claim 2, characterized in that the push rod (22) is rigidly supported by a housing (15) and along its length is provided with a force-sensing means (28).  
25 5. A device according to claim 4, characterized in that the force-sensing means (28) is an integrated portion of the push rod (22) or connected therein.  
30 6. A device according to any of the preceding claims, characterized in that the push rod (22) has a portion with reduced diameter in contact with the pressure-transmitting medium (20), said portion being surrounded by a sealing ring (23).  
7. A device according to any of the preceding claims, characterized in that the brake force is

transmitted the the pressure-transmitting medium (20) by a ring (19).

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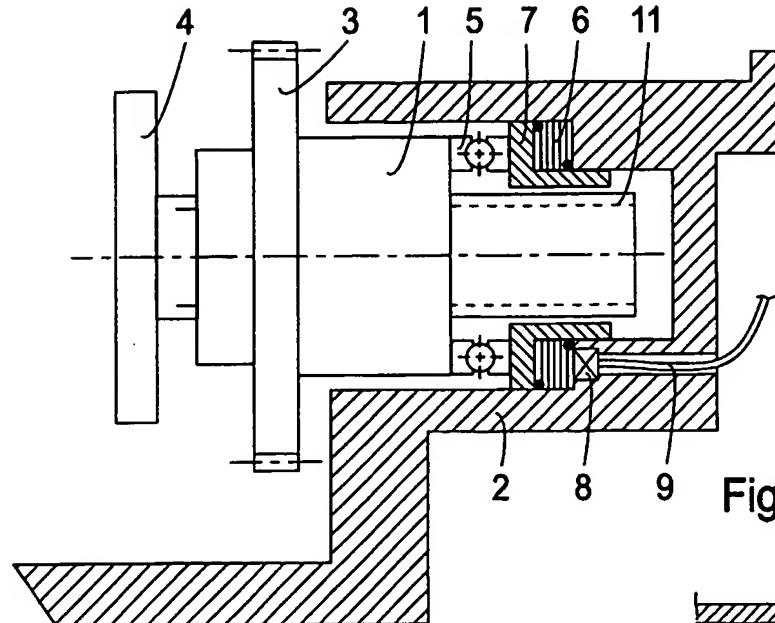


Fig. 1

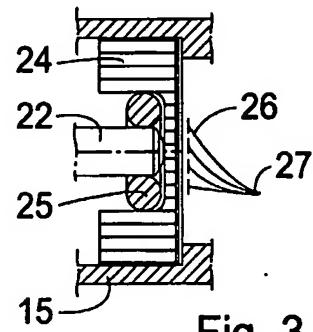


Fig. 3

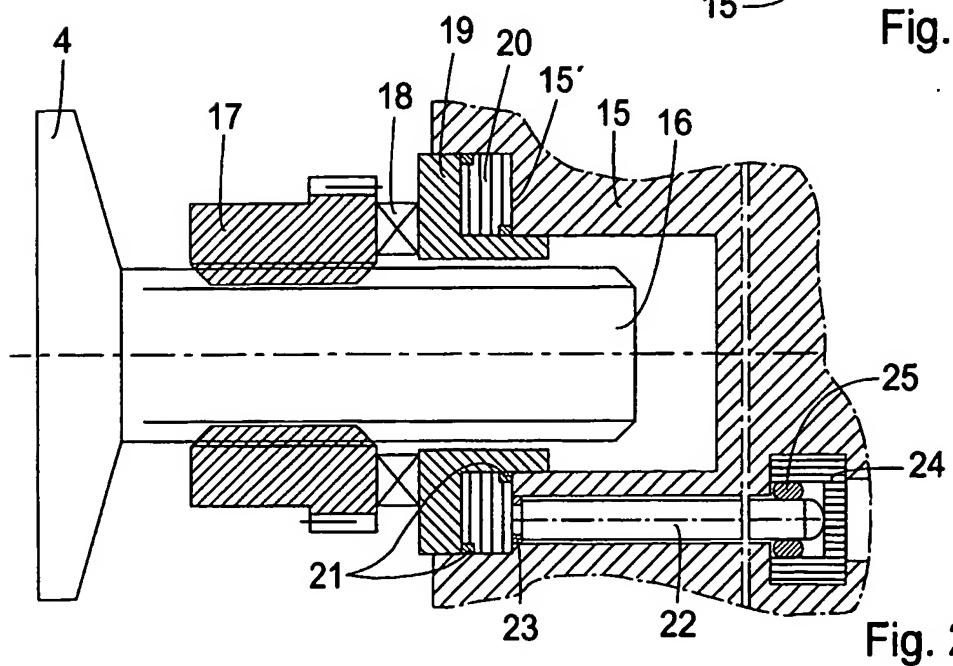


Fig. 2

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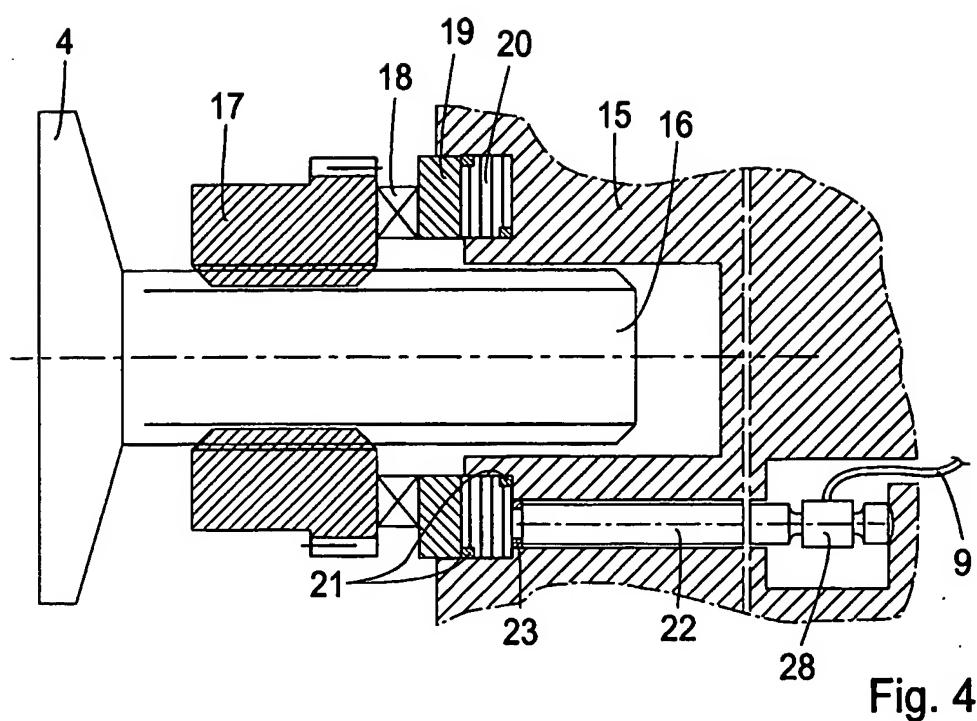


Fig. 4

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 02/00974

## A. CLASSIFICATION OF SUBJECT MATTER

**IPC7: B60T 17/22, F16D 66/00**

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

**IPC7: B60T, F16D**

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

**SE,DK,FI,NO classes as above**

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

**EPO-INTERNAL, WPI DATA, PAJ**

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 6176352 B1 (CHRISTOF MARON ET AL), 23 January 2001 (23.01.01), figure 1, claim 1, abstract  --	1
A	EP 0285773 A2 (ROBERT BOSCH GMBH), 12 October 1988 (12.10.88), figure 1, claim 1, abstract  --	1,2,4
A	DE 19652230 A1 (ITT AUTOMOTIVE EUROPE GMBH), 18 June 1998 (18.06.98), figure 1, abstract  --	1

 Further documents are listed in the continuation of Box C. See patent family annex.

* Special categories of cited documents:	
"A" document defining the general state of the art which is not considered to be of particular relevance	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"E" earlier application or patent but published on or after the international filing date	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
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## INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 02/00974

## C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5477943 A (NAOYASU ENOMOTO ET AL), 26 December 1995 (26.12.95), figure 4, abstract  -----	1

**INTERNATIONAL SEARCH REPORT**  
Information on patent family members

06/07/02

International application No.

PCT/SE 02/00974

Patent document cited in search report		Publication date	Patent family member(s)		Publication date
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US	5477943	A	26/12/95	JP	6148009 A
					27/05/94

DERWENT-ACC-NO: 2003-075875

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TITLE: Brake force determination device for  
heavy road vehicle,  
has axially movable push rod placed in  
contact with rubber medium to transmit force and  
includes sensor to detect transmitted force

INVENTOR: SEVERINSSON, L

PATENT-ASSIGNEE: HALDEX BRAKE PROD AB [HALDN] , SEVERINSSON  
L [SEVEI]

PRIORITY-DATA: 2001SE-0001885 (May 30, 2001)

PATENT-FAMILY:

PUB-NO	PAGES	MAIN-IPC	PUB-DATE	LANGUAGE
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BR 200209764 A	000	B60T 017/22	July 27, 2004	N/A
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CH CN CO CR CU CZ  
DE DK DM DZ EC EE ES FI GB GD GE GH GM HR HU ID IL IN IS JP  
KE KG KP KR KZ LC  
LK LR LS LT LU LV MA MD MG MK MN MW MX MZ NO NZ OM PH PL PT  
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SK SL TJ TM TN TR TT TZ UA UG US UZ VN YU ZA ZM ZW AT BE CH  
CY DE DK EA ES FI  
FR GB GH GM GR IE IT KE LS LU MC MW MZ NL OA PT SD SE SL SZ  
TR TZ UG ZM ZW

APPLICATION-DATA:

PUB-NO	APPL-DESCRIPTOR	APPL-NO
	APPL-DATE	
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May 22, 2002		
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May 30, 2001		
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N/A		
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May 22, 2002		
US20040154877A1	N/A	2003US-0722938
November 26, 2003		

INT-CL (IPC): B60T017/22, F16D055/08 , F16D066/00

ABSTRACTED-PUB-NO: WO 200296733A

BASIC-ABSTRACT:

NOVELTY - A rubber medium (20) is provided on which the brake force acts. An axially movable push rod (16) is placed in contact with the medium for transmitting a force. The sensors (28) provided in the push rod (22) sense the

force in the push rod.

USE - For determining applied brake force in heavy road vehicle.

ADVANTAGE - The sensors are placed on the movable push rod, the force on the push rod is detected precisely without any damage due to heat in the brake arrangement.

DESCRIPTION OF DRAWING(S) - The figure shows a schematic partial sectional side view of disc brake arrangement for vehicle.

Movable push rod 16

Rubber medium 20

Push rod 22

Sensors 28

CHOSEN-DRAWING: Dwg. 2/4

TITLE-TERMS: BRAKE FORCE DETERMINE DEVICE HEAVY ROAD VEHICLE  
AXIS MOVE PUSH ROD

PLACE CONTACT RUBBER MEDIUM TRANSMIT FORCE SENSE  
DETECT TRANSMIT  
FORCE

DERWENT-CLASS: Q18 Q63 S02 X22

EPI-CODES: S02-F03B; X22-C02; X22-P05; X22-X06;

SECONDARY-ACC-NO:

Non-CPI Secondary Accession Numbers: N2003-058737

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